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DEPARTMENT OF AGRICULTURE

Bulletin No. 200

SKIM-MILK CHEESE

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PREFACE.

There are few articles of food that contain as much nourishment in the same bulk, and that come to the table in so great a variety of forms, as cheese.

A pound of cheese contains nearly three times the amount of nutrient matter that is contained in a pound of beef, and it bears about the same relation in food value to butter.

It is not only a very nutritious food, but it is also classed among the most wholesome articles that go to make up the supply of a good table, so that when its cost is compared with the cost of other like nutritious foods its importance in making up the family ration is apparent.

Cheese that is made from the whole milk, or milk from which the butter fat has not been taken, is less nutritious than that which is made from skim-milk, while skim-milk when made into cheese brings, in the market, nearly, if not quite, as much as can be obtained from milk from which the butter fat has not been removed. Hence this bulletin has been prepared to call attention to, and describe methods used in the manufacture of skim-milk cheese, of which there are several varieties that are very popular throughout the country, and especially in large sections of our own State.

N. B. CRITCHFIELD,
Secretary of Agriculture.

LETTER OF TRANSMITTAL.

Lancaster, Pa., October 17, 1910.

Hon. N. B. Critchfield, *Secretary of Agriculture.*

Dear Sir: I have the honor to submit herewith a bulletin on "Skim-milk Cheese," as made and sold in Lancaster county, Pa.

The advanced agricultural standing of Lancaster county may be attributed to various causes. A dairy of 10 to 12 cows is quite common on a 75 to 100 acre farm. Where dairying is made a specialty, 18 to 20 cows are usually kept. The value of the skim-milk per year from 12 cows, producing 5,000 pounds of milk each, at 25 cents per hundred (the approximate feeding value of skim-milk when fed to calves or hogs) is about $125.00. At the price at which the various skim-milk cheese sell, the Lancaster county dairymen are realizing $300 to $750 for the same amount of skim-milk. The reader may think that $1.50 per hundred for skim-milk, when made into cheese, is extortion, but so long as the supply of the "right kind" is not equal to the demand the extortion is likely to continue. In passing through any of the six markets of Lancaster city, one will note that a majority of the farmers sell one or two of the varieties of skim-milk cheese herein described. Unquestionably the proceeds from the dairy by-products is one cause of the advanced agricultural standing of Lancaster county.

The method of manufacture of the different varieties of skim-milk cheese, herein described, varies slightly with different dairymen. The practice of several representative dairies will be described with such supplementary remarks as will enable the novice to adapt the methods given to his or her conditions.

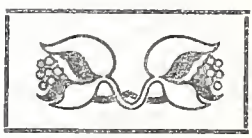
It is generally considered by scientists that the process of fermentation, properly controlled, aids in the digestibility of cheese. We trust that one or more of the Experiment Stations will investigate the matter of digestibility of the different varieties of skim-milk cheese; also how much, if any, milk sugar is retained in the egg or curd cheese.

The author is indebted to Misses C. Z. Hess, J. T. Harnish, J. G. Harnish and Wm. Shank, for some of the details of the art of cheese making herein described.

Hoping this bulletin will aid the dairyman in securing an enlarged income and the townsfolk a nutritious economical food, I am

Your obedient servant,

ENOS H. HESS.



SKIM-MILK CHEESE.

THE CURD.

The curd of milk is the material of which cheese is made. This consists of a nitrogenous substance closely resembling albumen of eggs, blood and vegetable matter, fibrin of flesh, gluten of wheat, oats, etc., and legumin of peas, beans and other leguminous plants.

The curd or casein will thicken or clabber naturally as the result of the milk-sugar decomposing and forming lactic acid. The acid thus formed combines with the free soda which always exists in normal milk in its fresh state, and this combination goes on until the alkali is all exhausted, when acid begins to accumulate.

Cheddar and many other cheese are made by treating the sweet milk with rennet which coagulates the curd or casein. The lactic ferment plays an important part in the future ripening of these cheese the same as those made from "sour curd."

COTTAGE CHEESE *(Schmierkase)*.

In the manufacture of cottage cheese, the skim-milk is allowed to sour until the casein has formed into a clabber. The whey is then removed. It can be removed without heating, by draining through muslin; but it is better to heat the clabbered milk to about 85° F. While warm, it is poured in a bag made of thin muslin, or preferably of crash toweling, and allowed to drain for 20 to 24 hours. The bag can be hung over a vessel so as to collect the whey if desired. The drained curd is then made fine by running through a curd mill as per Figure No. 1.

The mill (Fig. 1), is made by T. H. Smith, Myerstown, Pa., but can be made by any tinsmith. The size described will fit into a gallon crock. The cone is made of perforated tin No. 0, (20 perforations per inch). The cone is 5 inches long and $5\frac{1}{2}$ inches in diameter at top. The top is made of heavy tin 7 inches in diameter at top and $5\frac{1}{2}$ inches at bottom. An inch of No. 8 or 9 wire is soldered on each side. The wire serves as a support when the mill is placed in a crock. The arch or handle on top is made of heavy tinned strap iron with small hole in center for handle. The ends are fit into a notched ear which allows the arch to be removed when the mill is to be washed. The triangular board is made of hard wood so as to fit on inside of cone. The right side edges of the board are beveled. On the top a small iron washer with square hole is fastened, into which the turning handle is placed.

The curd, when ground, can be thinned with milk or cream if too thick. By the addition of cream the flavor is materially improved, but for marketing, heavy cream seasoning would likely be unprofitable. It is eaten as a side dish or spread on bread and sweetened with molasses, etc. Some people use pepper and salt in seasoning.

In preparing for market, a muslin or linen cloth is placed in an ordinary soup bowl which is then filled with cheese and the cloth folded. The cakes are then placed in a water-tight vessel, such as a dishpan or pail, to convey to market. The purchaser is expected to have a bowl or pail into which the cheese can be emptied out of the cloth.

About 1½ pounds sell for 5 cents, or 3 1-3 cents per pound. 100 pounds of skim-milk produces 18 or 20 pounds of cheese, or 60 to 70 cents worth.

BOILED CHEESE, POT CHEESE, CUP CHEESE, SCALDED CHEESE, *(Briekase.)*

The skim-milk is allowed to clabber as for cottage cheese. The clabbered milk is heated slowly to 130° or 150° F., placed in cheese bag and whey extracted by pressure. If the amount of curd is small, the whey can be sufficiently extracted by hand pressure and wringing the bag. The whey should be pressed out thoroughly while warm. The curd is then ground fine with a mill similar to the one used for cottage cheese. The cone is made of galvanized wire netting 4 to 5 meshes to the inch instead of No. 0 perforated tin as described for cottage cheese. A simple and more rapid method is to have a pan with sieved botton as per Figure No. 2.

A heavy tin dish-pan can be used for the purpose. The bottom is cut out leaving an outer rim one inch wide on which the screen is soldered. The galvanized wire screen should be four meshes to the inch. By rubbing the curd through the screen it will be made fine enough to set away for ripening. The lumps of curd should not be larger than a small pea for best results. The breaking can be done entirely by hand, but takes considerably longer than with a sieved pan.

The ground curd is then placed in any convenient vessel, but preferably in a shallow granite dish or stone crock. The fermentation proceeds the most rapidly when the layer of curd is not over four inches thick. The vessel should be covered with thin muslin to prevent contamination by flies, and yet allow free access of air. In the winter the cloth serves as a heat conserver and dust protector. In summer the dish is set in a cool place, but in winter it must be kept where it is warm. The curd will need to be mixed and the lumps which form as the fermentation progresses must be broken up once each day

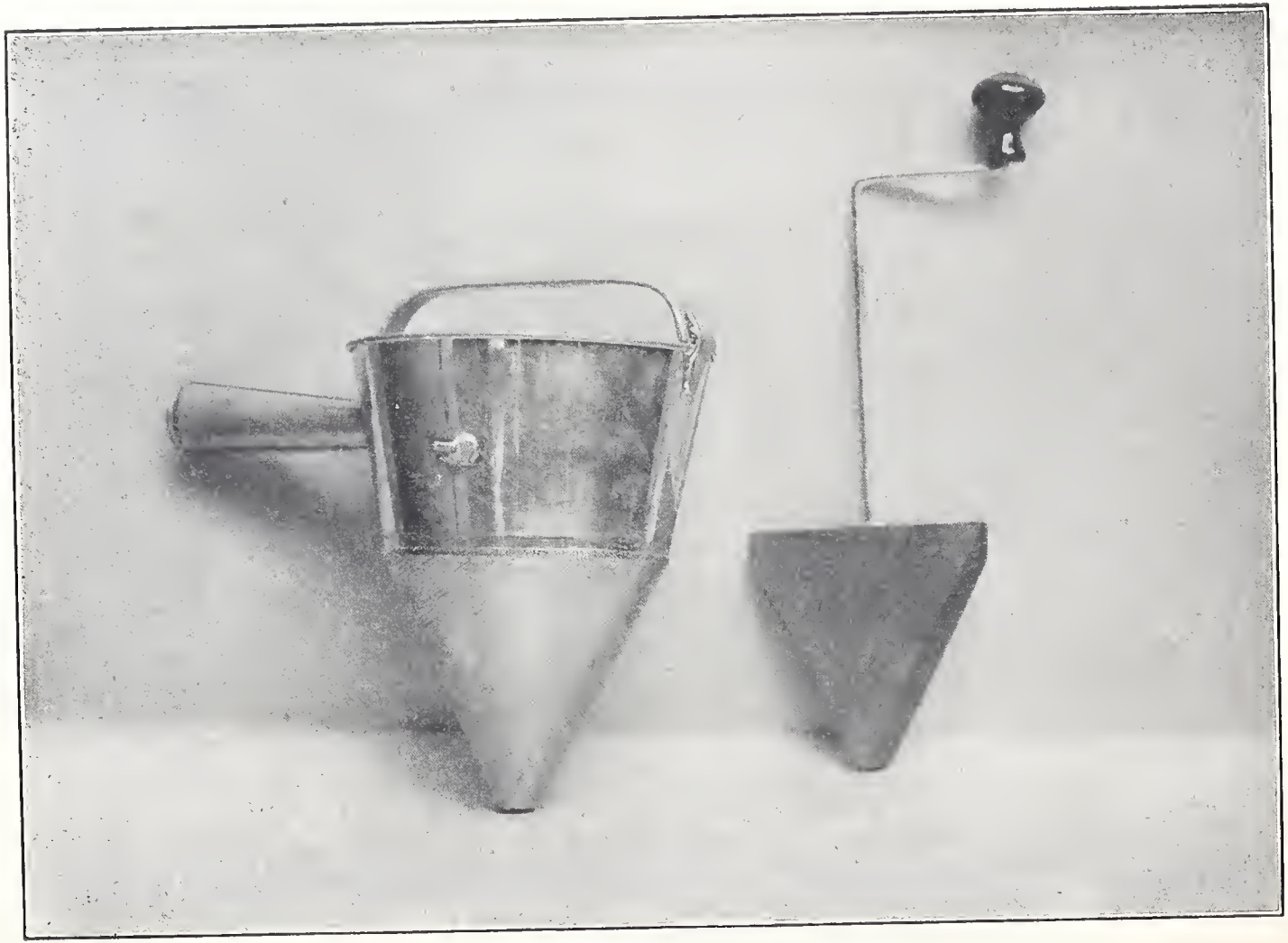


Fig. 1. Curd Mill.

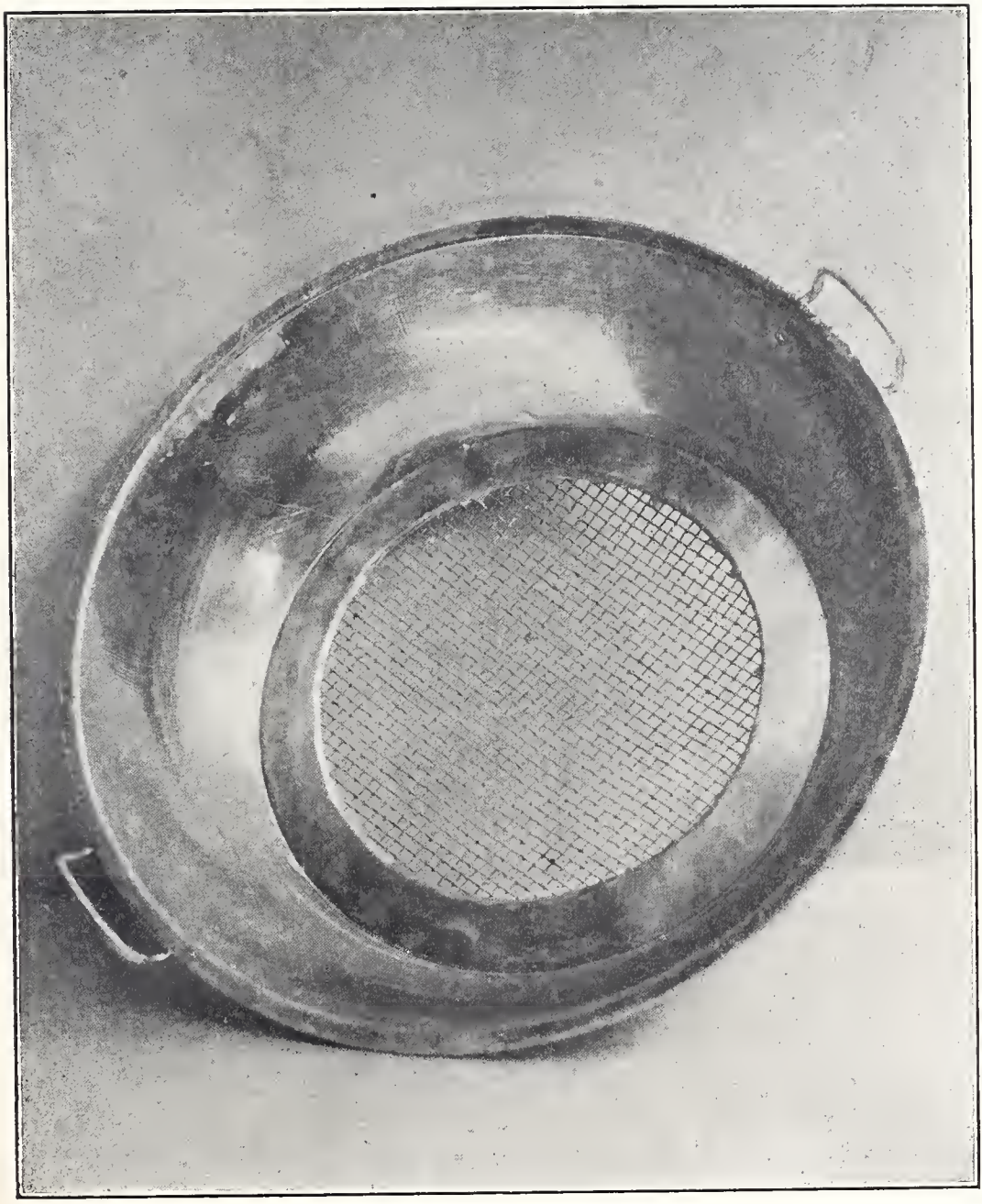


Fig. 2. Sieved Pan.

to insure even ripening or fermentation through the entire mass. Three to five days are required for the fermentation. It can be materially hastened by mixing baking-soda with the curd. Some people object to the soda being used as it materially changes the flavor of the cheese. However, in cold weather it is more frequently used than in warm weather. When soda is used, about one-half tablespoonful to three gallons of curd is mixed with the curd at the beginning of the fermentation process and another tablespoonful added when the curd begins to heat which is on the second or third day. At about the end of the second day of the ripening period the curd should be salted at the rate of one ounce of salt to three pounds of curd, more or less to suit taste. In ripening, the curd changes from a white to a dull straw color. When about three-fourths of each curd grain has fermented or changed in color, it is ready to be boiled.

To boil, it should be put into a shallow frying or baking pan about four inches deep, and water added in the proportion of one part water to six parts curd; less water in summer than in winter. It is then brought to the boiling point, being constantly stirred to prevent burning and allowed to boil for about five minutes or until the lumps are all dissolved and a smooth, somewhat mucilagenous mass is formed. While warm, it is poured into the marketing vessels —granite dishes, cups, bowls, etc.

An ordinary teacupful sells for three cents or two for five cents. A soup-bowlful or seven-eighths pint for five cents. Per pound it would equal five and one-half to seven cents. 100 pounds of skim-milk produces 12 to 14 pounds "Boiled Cheese" which sells for 65 cents to $1.00. The amount of heat applied to the curdled milk and amount of water added in boiling make the amount of cheese obtained variable.

DUTCH CHEESE, BALL CHEESE, *(Deutcherkase.)*

Natural Fermentation Method.

The skim-milk is allowed to clabber as for cottage or boiled cheese. If sweet separator skim-milk is used it will usually clabber sufficiently in two days. The second day it can be set in the sun's rays or in a warm room. When sufficiently clabbered the whey will come to the top at side of can. It is then poured into a bag made of crash toweling and placed in box, having slats on bottom to allow the whey to run off easily, and weighted. The cover to the box can be made so as to slide into the box and fastened to a fulcrum to which a weight can be applied; but a large stone on the loose top will do to press the whey out. After draining for twelve hours the bag should be turned and the curd well shaken up and again pressed

for six to ten hours. Some of the dairymen heat the clabbered milk to 85° or 90° F. and then press. The boiling decreases the amount of cheese obtainable from a given amount of milk.

The drained curd is next salted at the rate of one-half to three-fourths ounces per pound of curd, to suit taste, and thoroughly mixed until the particles of curd hang well together. The curd is then made into balls about the size and shape of a tomato. They vary in weight from six to eight ounces as made by the different dairymen. The balls are then placed on drying boards as per Figure No. 3.

The Drying Board.

The boards can be made any convenient size. In Fig. 3, the boards are partly drawn out. For a small dairy the above drying rack is very satisfactory. It is made of light lumber, lath placed 5 to 6 inches apart serving as cleates for the boards or shelves. The sides of the rack are covered with fine wire netting. One end is provided with a door. The advantage of a closed shelf rack is, that it can be moved to different places to suit the conditions of the weather. In clear, dry weather it is best to dry the balls in a cellar or slightly ventilated room; but in humid and cloudy weather the rack can be placed on the porch or any convenient place to allow free access of air. The fresh balls should be placed on the bottom shelf and elevated as the drying period continues. Where the cheese is to be made on a large scale, it would pay to have a building built for the purpose in which the temperature and humidity could be controlled. Figure 82, page 379 in The Dairyman's Manual, by Henry Stewart, gives a good illustration of how a drying room should be constructed. In the winter season the drying must be done in a warm room. When no better place is available it may be done in the furnace cellar, cupboard near stove, etc. It requires about six days in summer and ten to twelve days in winter to dry the balls sufficiently to be put into the curing room or box. During the drying period the balls should be turned as soon as they can be handled without breaking, which is about from 6 to 10 days in winter and 3 to 4 days in summer, Care needs to be exercised in turning the balls so as not to break them. In Figure 3 a few balls will be noticed that are broken. Figure 4 (a) and 4 (b) show a ball in good condition and one that is broken after being dried four days.

Figure 4 (c) shows the mold formed on the outside of the ball after drying 8 days and the reduction in size. The balls lose 45 to 50 per cent. in weight while on the drying boards. When the ball becomes broken, as in Figure 4 (b), it is practically worthless as the mold would penetrate the entire mass of the ball and cause an excess of waste when cleaned for the table or market. There are several

Fig. 3. Drying Board.

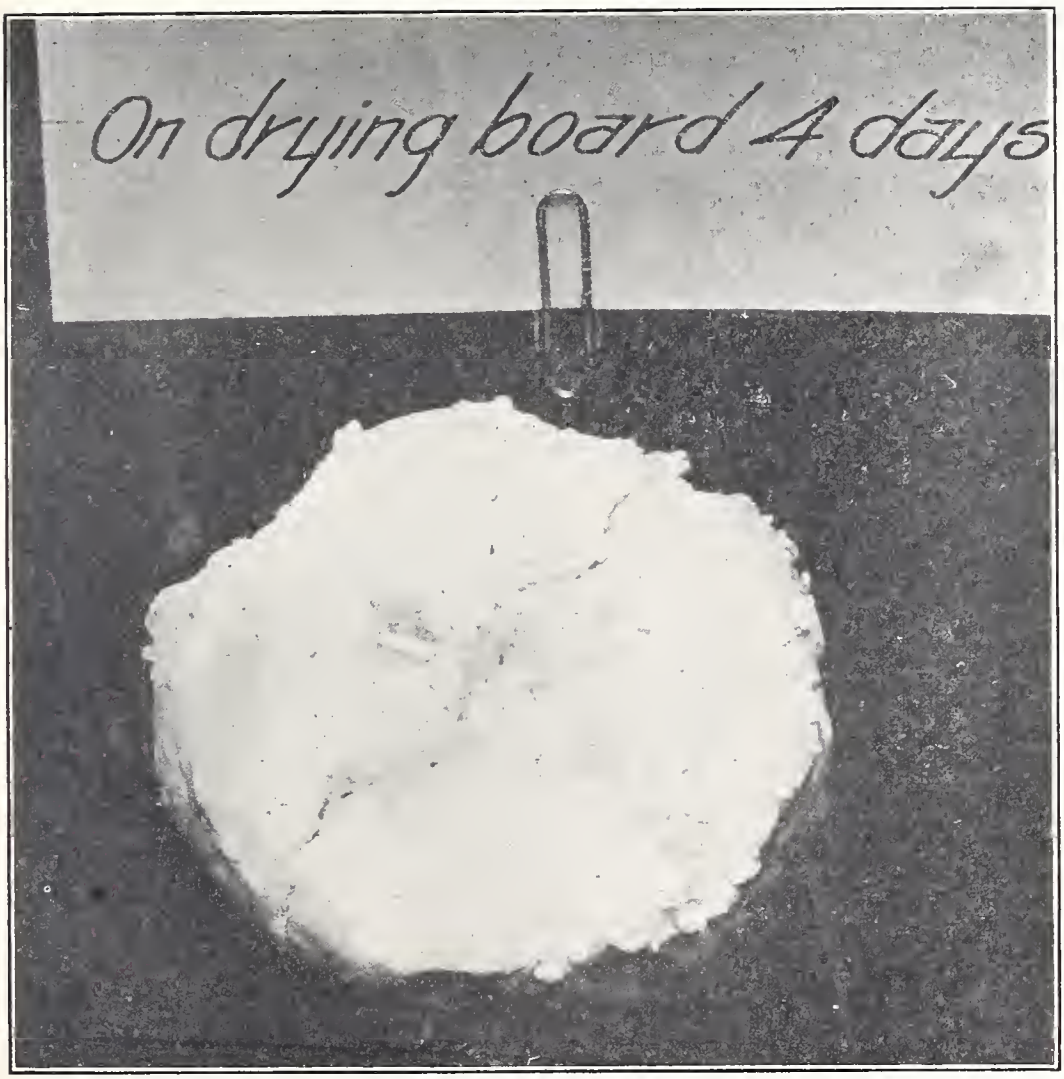


Fig 4 (a).

causes which tend toward broken balls which the novice will do well to guard against:

1. Too high heat in the clabber state of the milk resulting in too dry a curd caused by a too thorough separation of whey from curd.
2. Insufficient mixing of salt with curd.
3. Too rapid drying of balls.
4. Careless turning of balls.

Toward the close of the drying period a thin grayish blue mold develops on the balls and they become soft on the outside. The balls are then wrapped separately in paper and packed in small boxes and placed in the curing room. A cheddar cheese box answers the purpose very well. Where no separate curing room is available the boxes can be placed on the ground in the cellar. A damp cellar is better for the purpose than a dry one. In the winter it is well to cover the balls in the boxes with burlap to preserve the heat caused in the fermentation process.

The balls need be turned and separted once each week during the curing process, which requires 3 to 4 weeks to complete. The fermentation changes the white curd to a bright straw color. Some people prefer the curd to be entirely fermented, while others prefer about half to two-thirds fermented. After the curd is all fermented a strong odor and flavor develops which is objectionable to most people. It resembles limburger.

Ripening.

Figures 5 (a), (b), (c), and (d) show the development of the ripening process and change of color. The stage of ripeness as illustrated by 5 (c) is preferred, by many, to 5 (d).

When sufficiently ripened, the balls are removed from the boxes and placed in whey for 10 to 12 hours to soak the paper wrapper and outer mold loose. The balls are then partially cleaned and again placed in whey for 6 to 12 hours after which the grayish blue mold is all cleaned off and the balls rinsed in clean water and wrapped in parchment paper. Four balls are usually wrapped together which are sold for 10 cents. The four balls weigh from 10 to 12 ounces when ready for market. Thus the price per pound of cheese would be 13 to 16 cents. One hundred pounds of milk yields 50 to 60 balls, which would net $1.30 to $1.50 per hundred of skim-milk.

DUTCH CHEESE.

Soda Method.

The milk is allowed to clabber as in the natural fermentation method. It is then heated slowly to 85° F., in summer and 90° F. in winter, poured into a thin muslin or crash toweling bag and placed

in draining box and allowed to drain for 24 hours. No pressure is applied to the curd while draining in this method. The heating obviates the pressure. By heating of the clabbered milk, a more complete separation of the curd and whey is secured; but less cheese per 100 pounds of milk is obtained.

The drained curd is salted to taste, one-third to one-half ounce per pound of curd, thoroughly mixed and made into balls. The drying process is the same as outlined in the natural fermentation method. When sufficiently dried the mold that has formed is scraped off and the balls rubbed with baking-soda. During the winter the mold is not removed before applying the soda. The balls are then wrapped separately with paper (newspaper or soft manilla paper will answer) and allowed to ripen for 3 to 5 days when they are ready to be cleaned for market.

Figures 6 (a) and (b) show the rapid development of the fermentation as compared to the natural fermentation method. It will be noticed that the ball ripened 6 days by the soda method has about the same amount of curd unfermented as the ball ripened 19 days by the natural method. (See p—).

Many people do not like the soda cheese, and it does not bring as large returns for the milk used; however, the soda method has the advantage of taking less time to prepare the cheese for market.

The dairymen using the soda method usually have their balls weigh 3½ to 4 ounces when ready for market. Thus 4 balls which sell for 10 cents would weigh 14 to 16 ounces. The price per pound of cheese is 10 to 12 cents and the value of cheese per hundred pounds of milk is 90 cents to $1.10.

The loss in weight during the drying period is 45 to 50 per cent., the same as in the natural method, while the loss in ripening is usually most in the soda method; it varies from 5 to 10 per cent.

For convenience of comparison, the following table is given:

Amount and value of cheese obtained from 100 lbs. skim-milk.

Variety of Cheese.	Pounds of curd.	Pounds of cheese.	Value.	Cost per pound of cheese.
Cottage,	18 to 20	18 to 20	$0.60 to $0.80	$0.03 to $0.04
Boiled,	10 to 12	12 to 14	.65 to 1.00	.055 to .07
Dutch (Natural Method),	18 to 20	9 to 10	1.30 to 1.50	.13 to .16
Dutch (Soda Method),	15 to 17	8 to 9	.90 to 1.10	.10 to .12

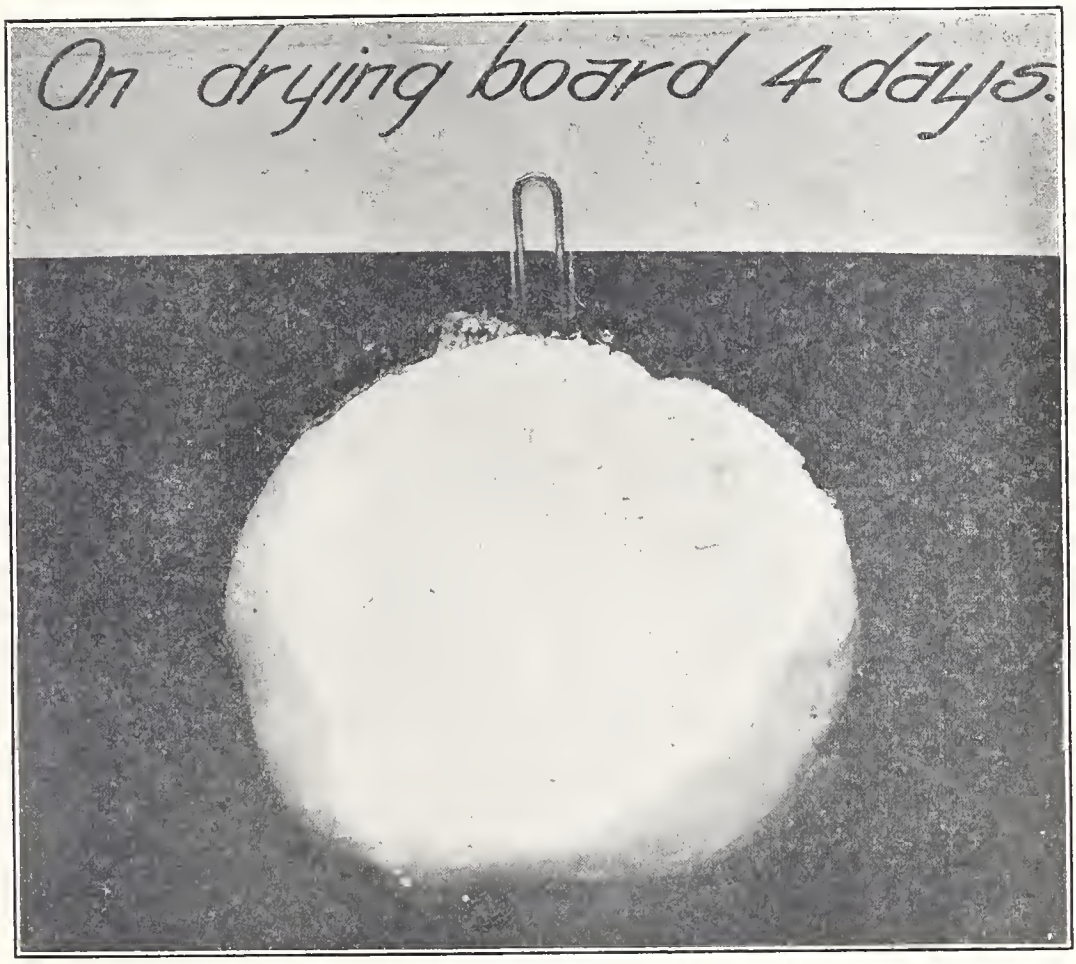


Fig. 4 (b).

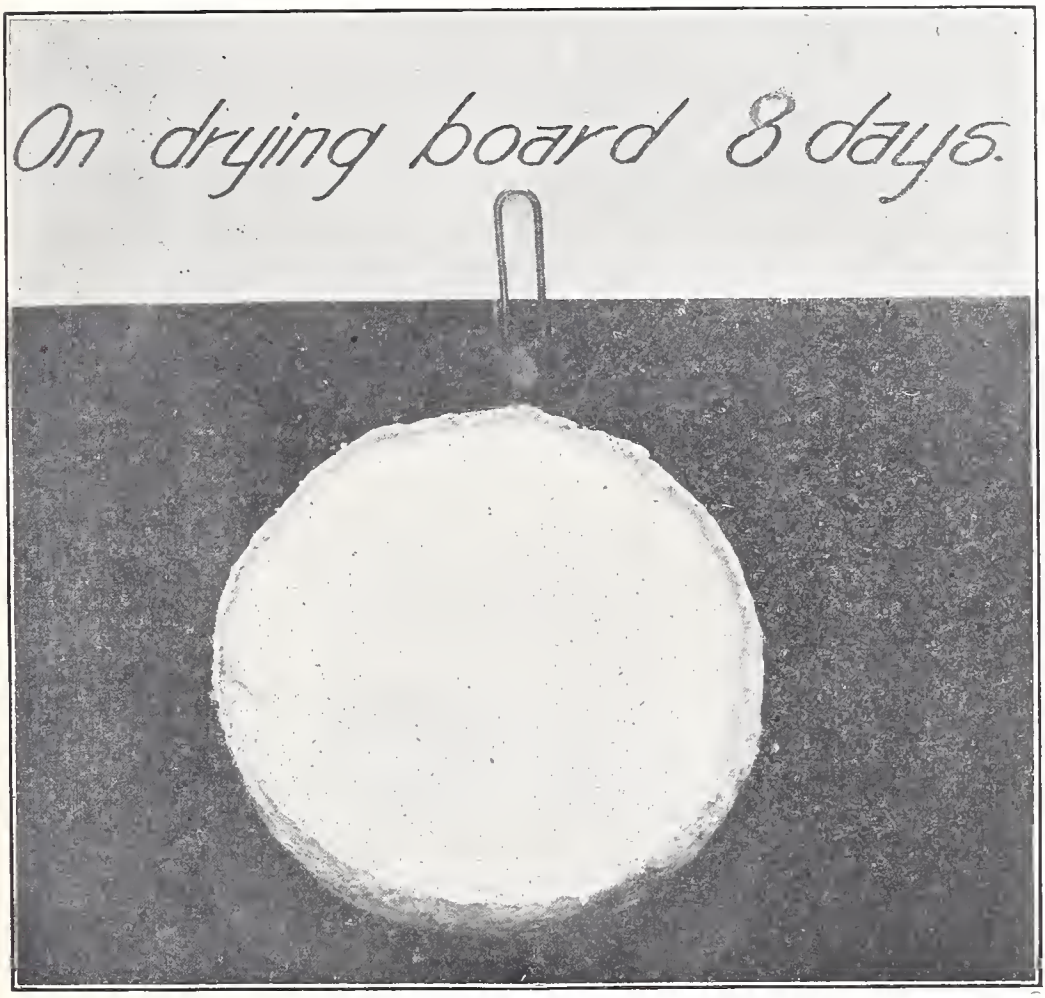


Fig. 4 (c).

Fig. 5 (a).

Fig. 5 (b).

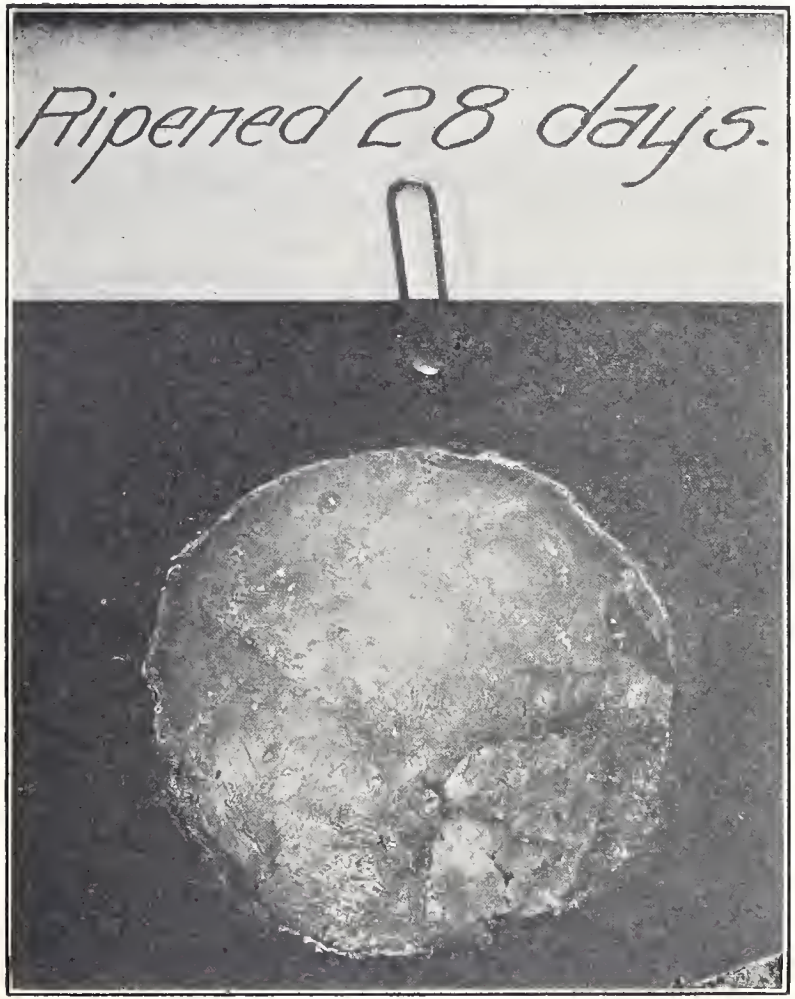


Fig. 5 (d).

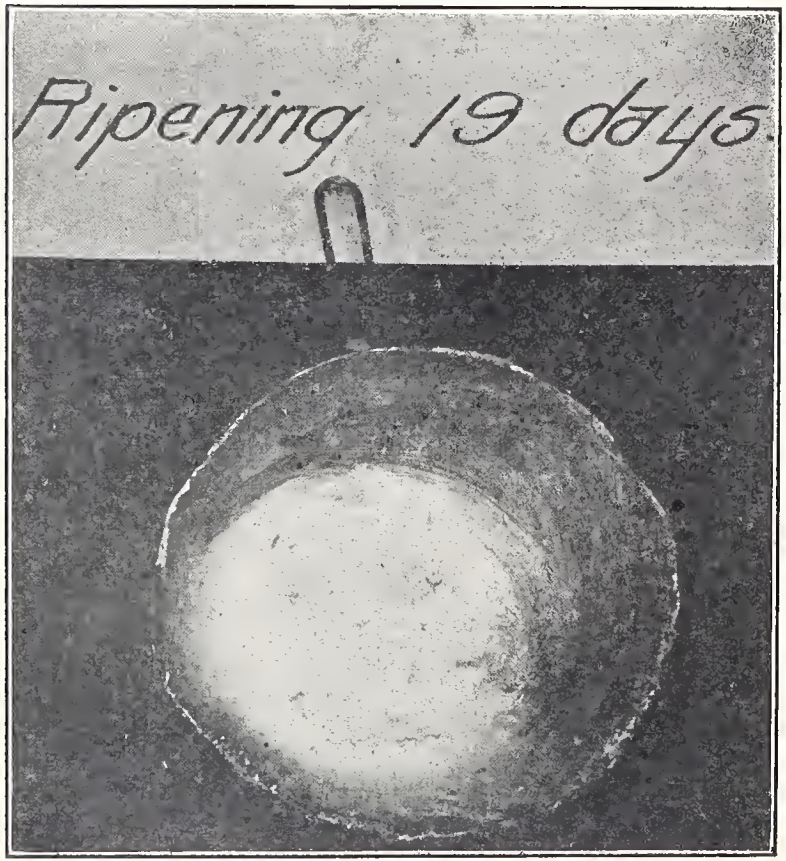


Fig. 5 (c).

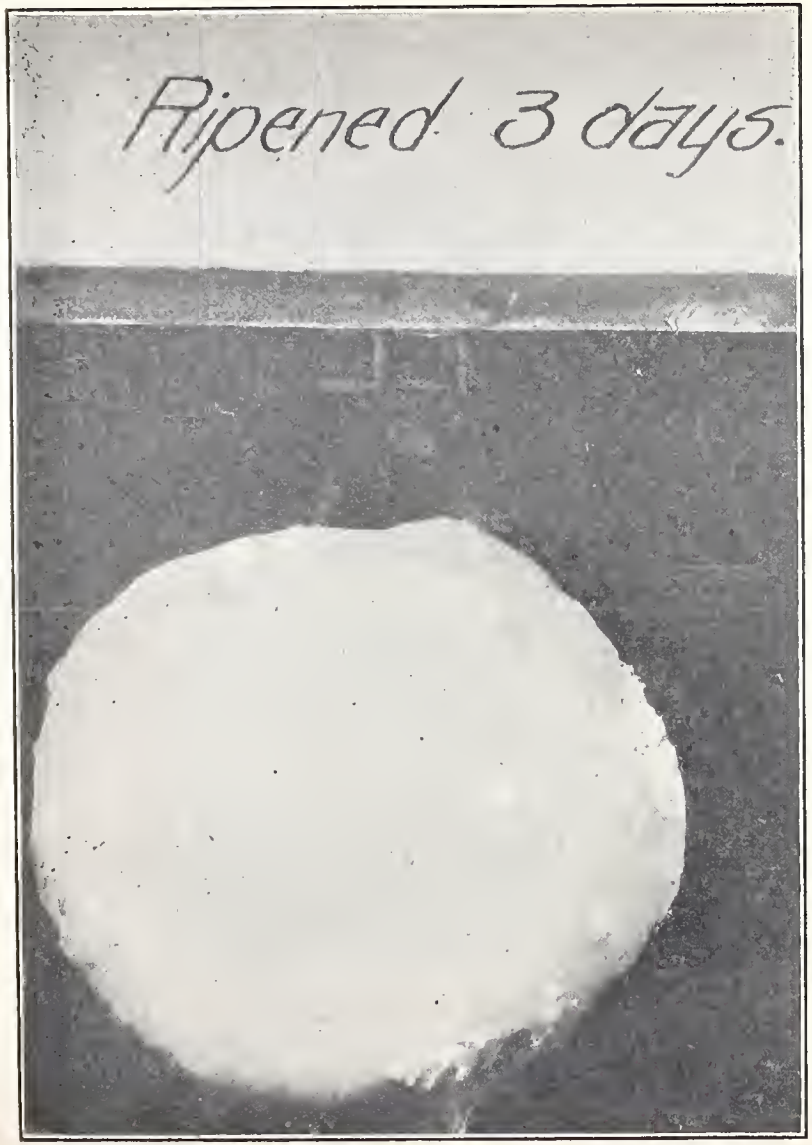
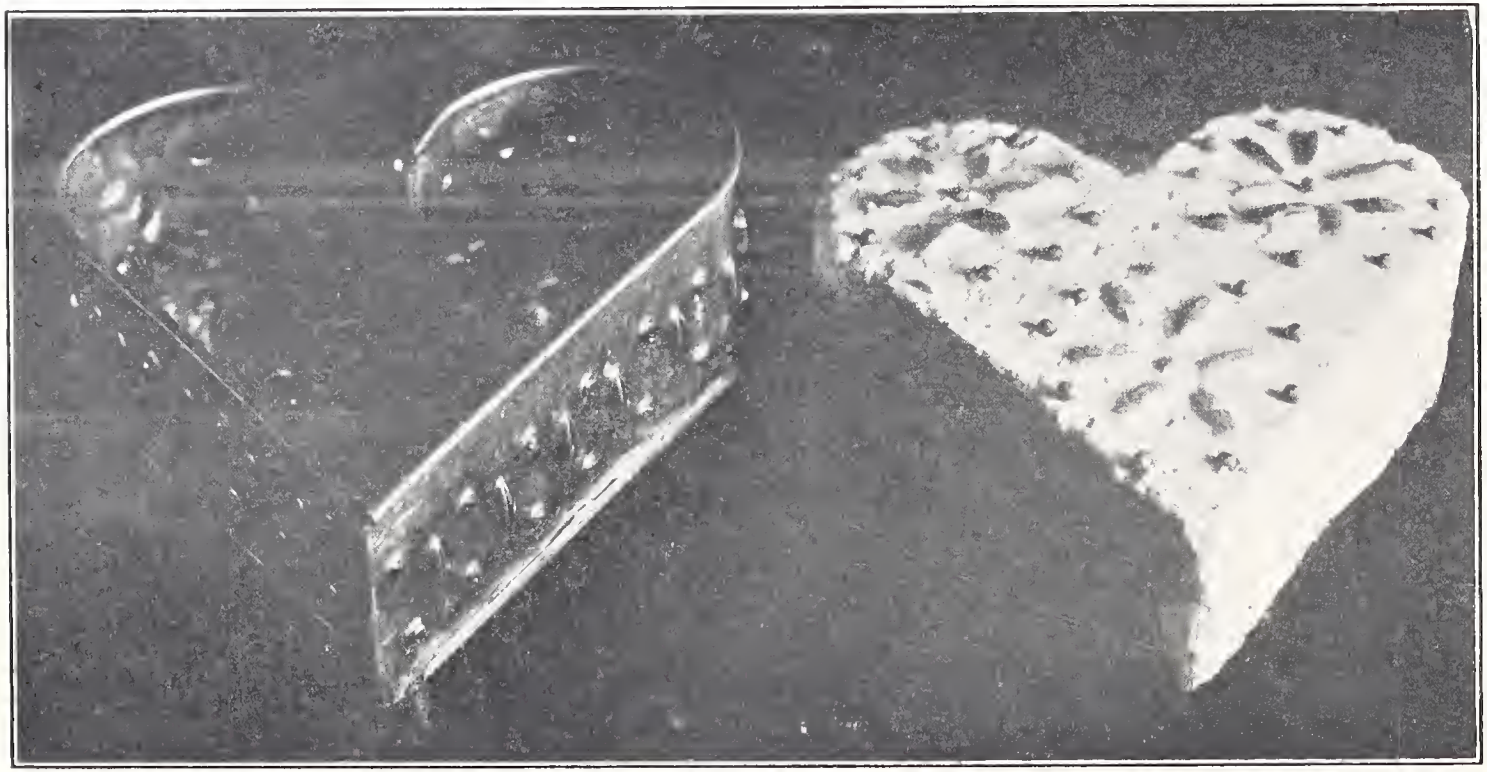


Fig. 6 (a).

Fig. 6 (b).



Figs. 7 (a) and (b).

EGG CHEESE, CURD CHEESE, EASTER CHEESE, *(Ziegerkase.)*

In the manufacture of egg cheese the method varies in different daries the same as with the other varieties aforementioned. One method is to batter four eggs into one quart of thick skim-milk and pour this mixture into one gallon of boiling sweet milk and continue to boil and stir rapidly for two minutes. The curd is then dipped off with a sieve bottom dipper and placed in perforated tin dish or mold as per Figure No. 7, and the whey allowed to drain off, or the entire mass can be poured into a bag and the whey allowed to drain off for 20 to 30 minutes before the curd is placed in the mold. If put into the mold with all the whey, considerable of the curd is washed out through the perforations of the mold.

Figure 7 (a) is the shape of mold mostly used for the purpose and 7 (b) the cheese as it appears when removed from the mold. The amount of this cheese sold on the Lancaster market is very small as compared with the other three varieties. It is sometimes called Easter cheese as the economical house-wife considers it unprofitable when eggs are selling at 35 to 40 cents per dozen. The cheese can be made without eggs if desired, but is nearly white in color instead of cream yellow when eggs are used. Another method is to mix one pint of whey with or without eggs into one gallon of boiling skim-milk and boil and stir for two or three minutes. The cheese made from the first formula sells for 20 cents.

Allowing 30 cents per dozen for the 4 eggs (10 cents) and $1.25 per hundred for the whole milk (10 cents) there would be no profit in its manufacture. The last formula is much cheaper, but the cheese is not so nutritious and finely flavored.